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ABSTRACT

Grade level norms were developed, based on a sample of 678 elementary school students, for various error scores of the Benton Visual Retention Test. Norms were also developed for 201 normal children, 58 minimal brain dysfunction children, and 101 educable mentally retarded children. In both the copying mode and the memory mode, most errors were categorized as distortion; the next most frequently occurring errors were omissions in the memory mode. The educable mentally retarded children made more errors than did the minimally brain damaged children, and both these groups made more errors than did the normal children. Error scores declined rapidly with age. (CTM)

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Visual Retention Test: An Analysis of Children's Errors

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In the Visual Retention Test (VRT) manual (1974), Benton notes the importance of the number correct and error scores as "the single most significant index of the presence of cerebral disease provided by the Visual Retention Test." He further comments the repeated observations by clinicians of "distinctive qualitative features having diagnostic significance."

The error scoring system "was designed to provide a stable framework for such qualitative analysis." (Benton, 1974). It includes the error categories most frequently mentioned in the literature: omissions (and additions), distortions, perseverations, rotations, misplacements and size errors. The number of "left" and "right" errors are also recorded.

Waller (1956) found that the performances of control and brain diseased adults differed significantly on the VRT, and while there was a trend to qualitative differences between these groups, it was statistically insignificant. The brain diseased patients made 3.0 times as many omissions, 3.5 times as many rotations, and 5.6 times as many size errors as the controls. Cronholm and Scalling (1963) report more omission and perseveration errors in organic brain syndrome patients. Watson (1968) compared schizophrenic and organic brain syndrome patients, finding more distortions and perseverations in the VRT protocols of schizophrenics.

Meaningful qualitative inferences might also be made concerning the VRT performances of school children, especially during their early, formative years when appropriate intervention is most critical. If the clinical observations alluded to earlier have relevance for the VRT performances of children, then the

logical point of departure for investigation is determination of an error pattern for normal children. Such norms would provide a basis for comparison with various diagnostic groups of interest to future investigators. Clinical users would have normative performance standards against which to judge individual outcomes.

The purpose of the present study is the determination of normative error patterns for the VRT performances of school children by age levels, 5-0 through 11-11; and, to compare error patterns for normal, minimal brain dysfunction (MBD) and educable mentally retarded (EMR) children, matched on age.

Procedures

Sample. The sample is composed of 678 children, ages 5-0 through 11-11, enrolled in six elementary schools in the Aldine Independent School District, Harris County (Houston), Texas. The district has a school population in excess of 30,000 from wide socio-economic and multi-ethnic backgrounds. Selection was random, except to note that most children were tested within six weeks of their birthdates.

Children for the diagnostic groups ANOVAs were matched on CA. The N's for these groups are: normals, 201; MBD, 58; and EMR, 101. The normal sample was drawn randomly from the assigned classrooms of regular class children. The MBD sample were virtually all the children assigned to such classes on the basis of academic and/or behavioral deficits, and, neurological and/or medical examinations. The EMR sample was comprised of all children so placed on the basis of an earlier intellectual assessment, and, that were within the age limitations of the study.

Administration. Testing and scoring was accomplished by first and second year graduate students in psychology and education at the University of Houston while enrolled in a course in psychological assessment taught by the author. All received a thorough introduction to, and substantial practice with, the VRT prior to field testing for the study. Test-retest reliability coefficients for the various

scoring categories, corrected for restricted intellectual range, varied from .87 to .89 for 50 kindergarten children, and from .85 to .91 for 49 third grade children.

Methods. One-between and one-within ANOVAs were calculated for the six error categories, and for left-right errors, for Administrations A (Memory) and C (Copy). The between-groups variables are levels of CA, and the three diagnostic groups - normal, MBD and EMR.

Results

Results for the ANOVA for Administration C errors by age levels appear in Table 1 and Figure 1, and in the latter, the numbers '1' through '9' identify in ascending order the performance curves for each age level. CA, Errors, and the CA x Errors interaction are significant. All error categories except perseverations decline with age through age seven. Distortion, and to a modest extent omission, errors significantly discriminate among the first five age levels. Administration C has very little discriminatory value at the older age levels. Errors in the right visual yield predominate over those in the left only through the sixth year, this due to the very few total errors made by children beyond age seven. CA, L/R Errors, and CA x L/R Errors interaction are significant.

Results of the ANOVA for Administration A are given in Table 2 and Figure 2. While progression with age is evident, only distortions, and to a lesser extent, omissions reflect an age-to-age decline of diagnostic significance. As in Administration C, perseverations are the least discriminative, few such errors may be normal children. CA, Errors, and CA x Errors interaction are significant. Throughout the entire age range, errors in the right visual field predominate over those in the left. This effect is quite marked at the earlier levels, but tends to narrow as a ceiling is reached at the older age levels. CA, L/R Errors, and CA x L/R Errors interaction are significant.

Results for the Administration C ANOVA by diagnostic groups appear in Table 3 and Figure 3. Distortions are most effective in discriminating among the three groups. Rotations occur more frequently in EMR than MBD and normal children. The Groups, Errors, and Groups x Errors interaction are significant. There was no right-over-left supremacy. Groups effect was significant, but this was not so for the L/R Errors effect nor the Groups x L/R Errors interaction.

Results for Administration A ANOVA by diagnostic groups appear in Table 4 and Figure 4. Normal children made the fewest errors, followed by MBD and EMR children. Groups, Errors, and Groups x Errors interaction are significant. Distortions and omissions discriminate effectively among the groups. Right errors occur more frequently than left in all groups. Groups, L/R Errors, and Groups x L/R Errors interaction are significant.

Discussion

Distortion and omission errors are most effective in discriminating among the four youngest age levels for Administration C, and among the six youngest age levels for Administration A. While the interactions in both ANOVAs are significant, these seem to have little diagnostic importance. No marked pattern differences occur as a function of age. Perseveration errors are virtually absent in Administration C, the protocols of children making such errors deserving of special scrutiny. The right-over-left error phenomena seems the logical outcome of forgetting, the right figures in the designs requiring the longest retention, and in greatest danger of interference in retention from the left figures.

The means in Tables 1 and 2 are numerical and percentage expectancies by age levels for the various error categories, the left-right percentages of special significance. Between the first two age levels on Administration A, the left-right difference is 2.5, enough to mislead anyone with expectations that

left and right errors should, by chance, occur with equal frequency.

Diagnostic groups are well-differentiated. While the interactions were significant in the ANOVAs of both administrations, these do not reflect diagnostically significant pattern differences. It is a mild disappointment that distinctive pattern differences did not emerge for the MBD group, but 'MBD' as applied, often represents behavioral as well as cognitive deficits.

The weighty influence of distortions seems to militate against a serious concern with the remaining error categories. This is deceptive, for on the assumption that these categories were identified on the basis of neurological and neuropsychological inferences for the presence of brain injury or disease, few such errors should be found in the VRT protocols of normal children. Those that are present should be found in the protocols of young children, and these should decline rapidly with increasing age. This is, in fact, the case.

Summary

Normative error patterns by age levels and by diagnostic groups have been determined for the VRT performance of school children. Distortion, and to some extent omission, errors differentiate most effectively among age levels. This is a logical outcome if clinical observations over the years have accurately defined the types of errors most frequently made by individuals lacking cortical integrity. These error patterns provide a normative reference for both researchers and clinicians.

References

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Biographical Sketch

James A. Rice, Associate Professor of Psychology at the University of Houston, was granted a Ph.D. by the University of Iowa in 1967. Research interests focus on test validation in the areas of perceptual-motor/memory functioning, learning disabilities, and rehabilitation.

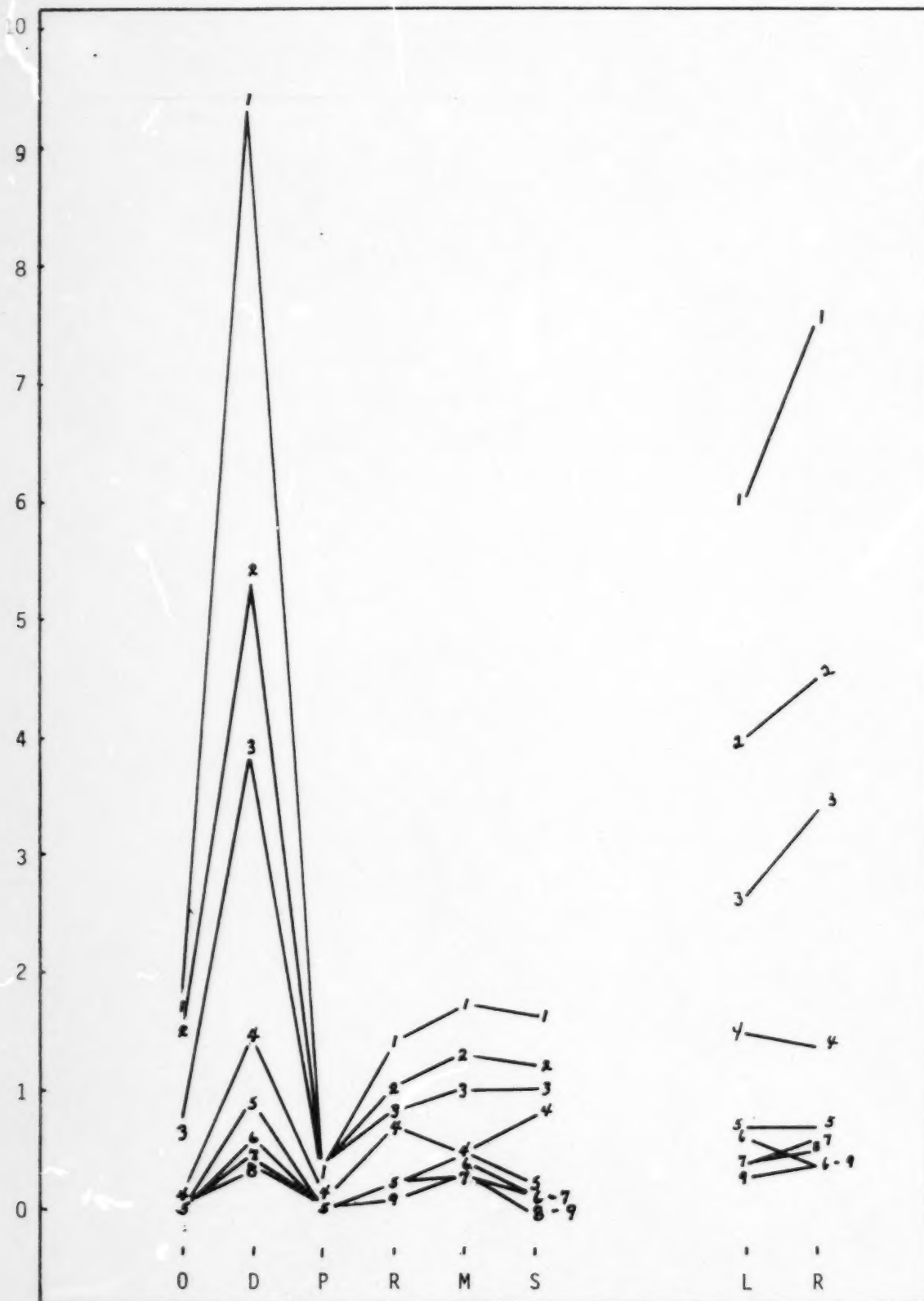


FIG. 1 ADMINISTRATION C (COPY) BY CA

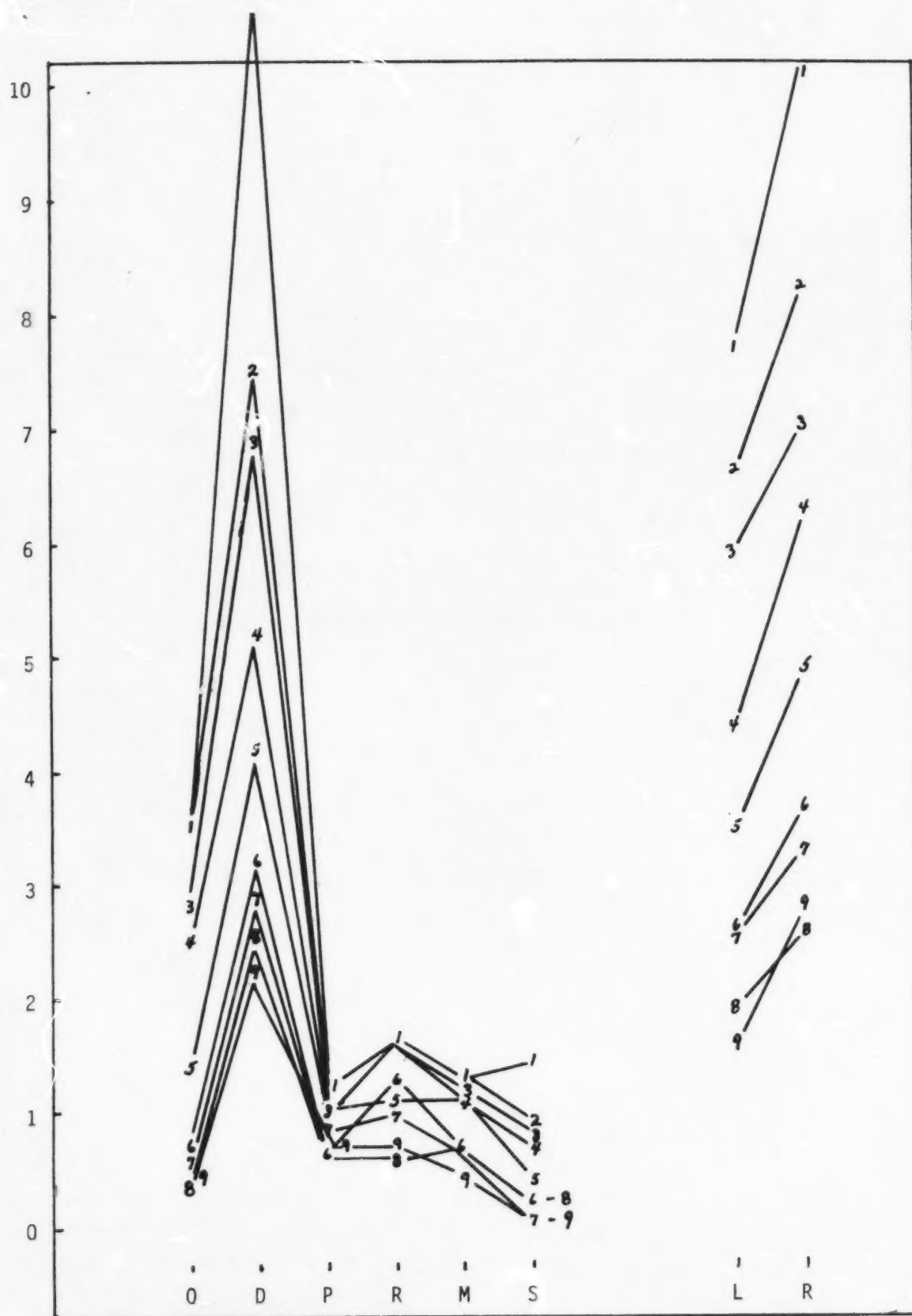


FIG. 2 ADMINISTRATION A (MEMORY) BY CA

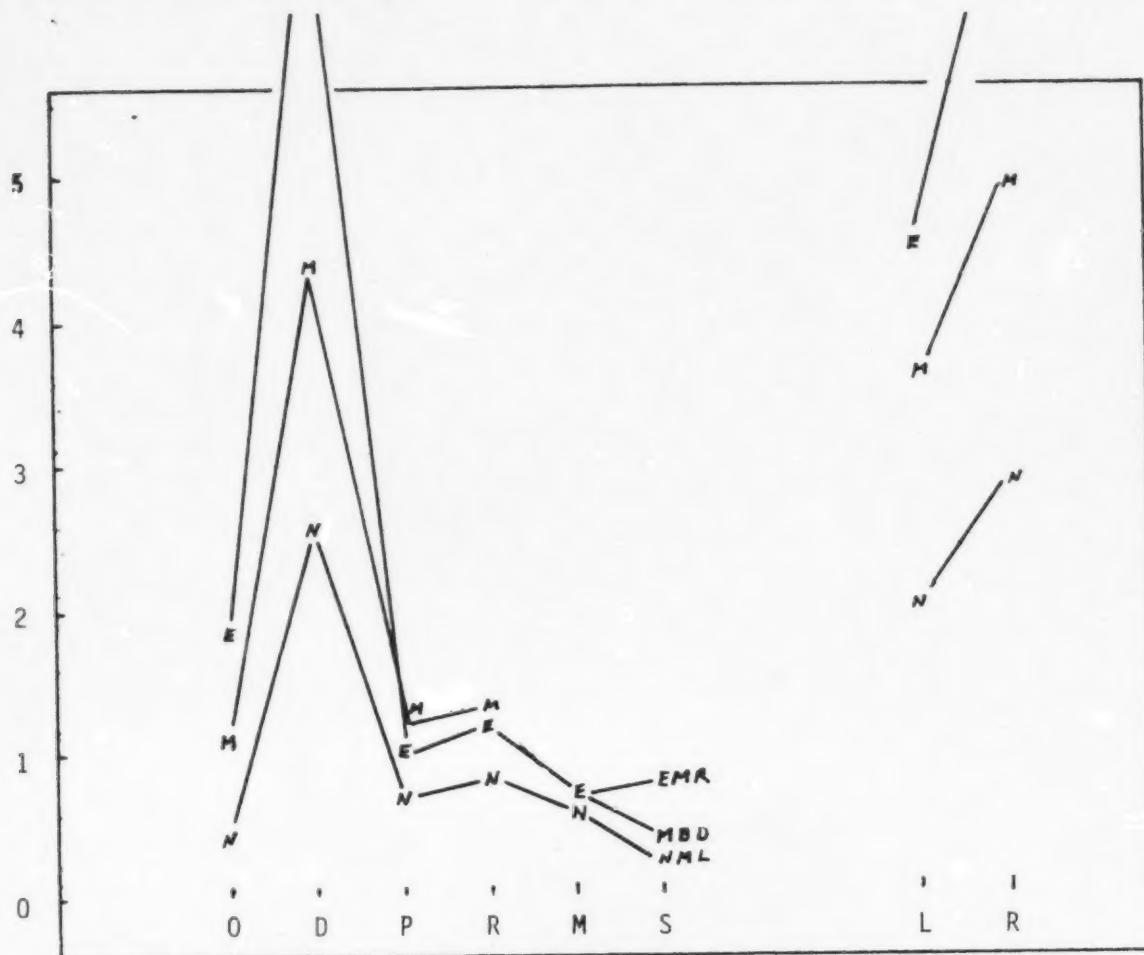


FIG. 4 ADMINISTRATION A (MEMORY) BY DIAGNOSTIC GROUPS

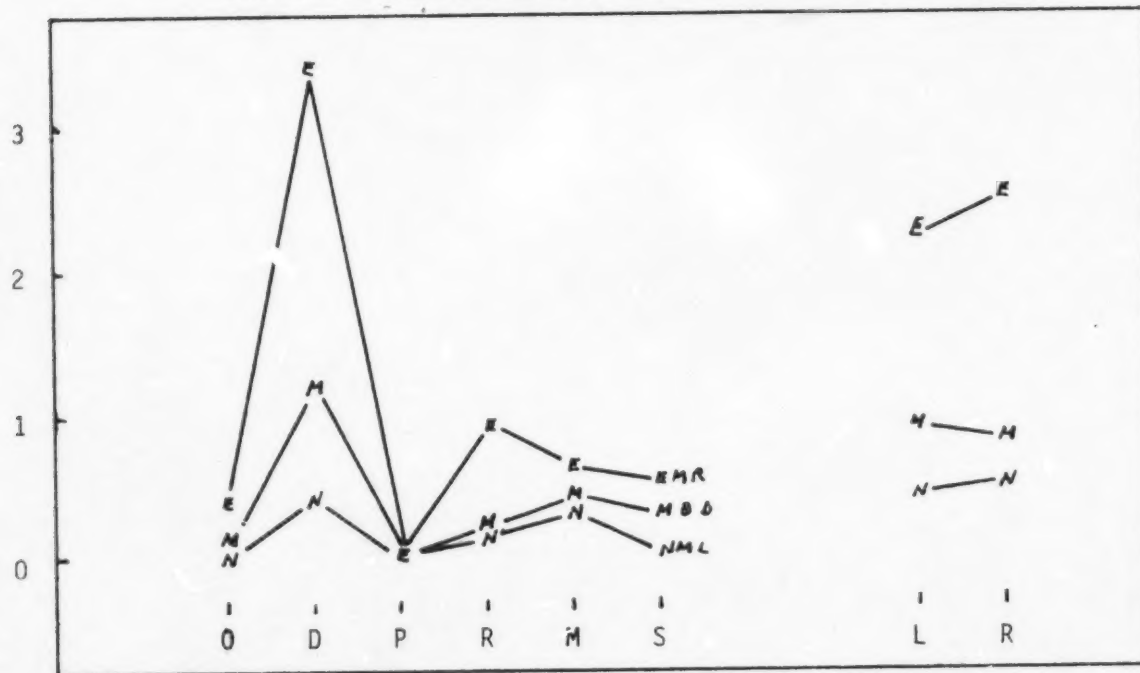


FIG. 3 ADMINISTRATION C (COPY) BY DIAGNOSTIC GROUPS

Table 1

VRT Administration C (Copy) Errors by Categories and Age

CA Grp	$\bar{x}$	Omiss		Dist		Per		Rot'n		Mispl		Size		Left		Right	
		$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%
1	5-4	1.7	11	9.4	59	.1	0	1.4	9	1.7	11	1.6	10	6.0	44	7.5	56
2	5-9	1.3	12	5.4	52	.2	2	1.0	10	1.3	13	1.2	11	4.0	47	4.5	53
3	6-2	.7	10	3.9	51	.2	2	.8	11	1.0	13	1.0	13	2.7	44	3.4	56
4	6-7	.1	2	1.5	42	.0	0	.7	19	.5	14	.8	23	1.5	52	1.4	48
5	7-9	.0	1	.9	50	.0	0	.2	12	.5	28	.2	9	.7	50	.7	50
6	8-8	.0	0	.6	48	.0	2	.2	17	.4	30	.0	3	.6	60	.4	40
7	9-8	.1	8	.3	27	.0	1	.2	15	.4	38	.1	11	.4	44	.5	56
8	10-8	.0	1	.5	47	.0	1	.2	14	.3	32	.1	5	.4	40	.6	60
9	11-9	.1	9	.4	43	.0	2	.1	8	.3	36	.0	2	.3	43	.4	57
	$\bar{x}$	.5	10	2.5	51	.1	1	.5	11	.7	15	.6	12	1.9	48	2.1	52

CA: $F = 102.8$; $P(F < 2.51, df=8.00) = .01$ Errors: $F = 255.9$; $P(F < 3.02, df=5.00) = .01$ CA x Errors: $F = 40.2$; $P(F < 1.00, df=40.00) = .01$ CA: $F = 91.1$; $P(F < 2.51, df=8.00) = .01$ L/R Errors: $F = 19.1$; $P(F < 6.63, df=1.00) = .01$ CA x L/R: $F = 6.1$; $P(F < 2.51, df=8.00) = .01$

Table 2

VRT Administration A (Memory) Errors by Categories and Age

CA Grp	$\bar{x}$	Omiss		Dist		Per		Rot'n		Mispl		Size		Left		Right	
		$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%
1	5-4	3.4	18	10.9	57	.6	3	1.4	7	1.3	7	1.4	8	7.7	43	10.2	57
2	5-9	3.5	22	7.5	48	1.0	6	1.6	10	1.3	8	.9	6	6.6	45	8.2	55
3	6-2	2.8	19	6.9	48	1.2	8	1.4	10	1.2	9	.8	6	5.9	46	7.0	54
4	6-7	2.5	21	5.2	43	1.0	9	1.4	12	1.1	9	.7	6	4.4	41	6.3	59
5	7-9	1.4	15	4.2	45	1.2	12	1.1	12	1.1	12	.4	4	3.5	42	4.9	58
6	8-8	.7	10	3.2	46	.8	12	1.3	19	.7	10	.2	3	2.6	41	3.7	59
7	9-8	.6	10	2.9	46	.9	14	1.0	15	.8	13	.1	2	2.6	41	3.3	59
8	10-8	.3	7	2.3	48	.7	14	.7	16	.5	11	.2	4	1.9	42	2.6	58
9	11-9	.3	5	2.6	54	.6	12	.6	12	.7	14	.2	3	1.6	36	2.8	64
	$\bar{x}$	1.8	17	5.0	48	.9	9	1.2	12	1.0	9	.5	5	4.2	43	5.5	57

CA: $F = 107.5$; $P(F < 2.51, df=8.00) = .01$ Errors: $F = 599.2$; $P(F < 3.02, df=5.00) = .01$ CA x Errors: $F = 24.4$; $P(F < 1.00, df=40.00) = .01$ CA: $F = 120.6$; $P(F < 2.51, df=8.00) = .01$ L/R Errors: $F = 212.7$; $P(F < 6.63, df=1.00) = .01$ CA x L/R: $F = 3.9$; $P(F < 2.51, df=8.00) = .01$

Table 3

VRT Administration C (Copy) Errors by Categories and Diagnostic Groups

CA		Omm		Dist		Per		Rot'n		Mispl		Size		Left		Right	
Grp	$\bar{x}$	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%
N	10-9	.0/5		.4/40		.0/2		.1/12		.3/36		.0/5		.4/44		.5/56	
EMR	11-1	.4/7		3.4/58		.0/1		.9/15		.6/10		.5/9		2.2/46		2.5/54	
MBD	10-9	.1/3		1.2/54		.0/0		.2/11		.4/17		.3/15		.9/53		.8/47	
	$\bar{x}$	.2/7		1.4/54		.0/1		.3/13		.4/16		.2/9		1.0/48		1.1/52	

Grps: $F = 66.2$; $P(F \leq 4.61, df=2.00) = .01$ Errors: $F = 67.0$; $P(F \leq 3.02, df=5.00) = .01$ Grps x Errors: $F = 32.9$; $P(F \leq 2.32, df=10.00) = .01$ Grps: $F = 56.6$; $P(F \leq 4.61, df=2.00) = .01$ L/R Errors: $F = 3.3$; $P(F \leq 6.63, df=1.00) = .01$ Grps x L/R: $F = 2.0$; $P(F \leq 4.61, df=2.00) = .01$

Table 4

VRT Administration A (Memory) Errors by Categories and Diagnostic Groups

CA		Omm		Dist		Per		Rot'n		Mispl		Size		Left		Right	
Grp	$\bar{x}$	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%
N	10-9	.4/8		2.6/50		.7/13		.8/14		.6/12		.2/3		2.0/42		2.8/58	
EMR	11-1	1.9/15		7.1/56		1.0/8		1.2/9		.7/5		.8/7		4.5/40		6.8/60	
MBD	10-9	1.1/12		4.4/49		1.2/13		1.3/15		.7/7		.4/4		3.6/42		4.9/58	
	$\bar{x}$	.9/12		4.1/52		.9/11		1.0/12		.6/8		.4/4		3.0/41		4.3/59	

Grps: $F = 99.9$; $P(F \leq 4.61, df=2.00) = .01$ Errors: $F = 285.5$; $P(F \leq 3.02, df=5.00) = .01$ Grps x Errors: $F = 39.3$; $P(F \leq 2.32, df=10.00) = .01$ Grps: $F = 95.3$; $P(F \leq 4.61, df=2.00) = .01$ L/R Errors: $F = 126.2$; $P(F \leq 6.63, df=1.00) = .01$ Grps x L/R: $F = 15.9$; $P(F \leq 4.61, df=2.00) = .01$